

CLAIMS

What is claimed is:

1. In a process for the heterogeneous catalytic reaction of a mixture of a reactant gas and reactant liquid in a monolith catalytic reactor under conditions of reaction, the improvement which comprises initially mixing the reactant gas with the reactant liquid in a static mixer thereby forming a frothy mixture, introducing the resultant frothy mixture into the monolith catalytic reactor for reaction, and, then, recovering reaction product from the monolith catalytic reactor.

2. The process of Claim 1 wherein the monolith catalytic reactor has from 100 to 1200 cells per square inch.

3. The process of Claim 2 wherein the frothy mixture is passed upflow through said monolith catalytic reactor at a superficial velocity of from 0.1 to 2 meters per second.

4. The process of Claim 3 wherein the static mixer is comprised of a plurality of sections, each section comprised of a tubular housing having a flow direction along an axis carrying a plurality of stationary, rigid elements that form interengaging and intersecting channels in the flow direction and which extend angularly to the longitudinal axis.

5. The process of Claim 4 wherein the static mixer is comprised of a plurality of mixing sections with each mixing section rotated about the longitudinal axis in the direction of flow from the preceding section.

6. The process of Claim 5 wherein the alternating parallel channels intersect at angles from 45 to about 90 degrees to the longitudinal axis.

5 7. The process of Claim 6 wherein a plurality of sections in the static mixer are rotated from about 45 to 90 degrees about the longitudinal axis from the preceding section in the direction of flow.

10 8. The process of Claim 7 wherein the bubble size of reactant gas is from 0.5 to 5 times the cell width or hydraulic diameter and the monolith catalytic reactor has from 200 to 600 cells per square inch.

15 9. The process of Claim 8 wherein the organic compound used in the hydrogenation reaction is selected from the group consisting of a nitroaromatic, a nitrile, an unsaturated organic, and reaction products of a ketone or aldehyde with ammonia or a primary or secondary amine.

20 10. The process of Claim 9 wherein the organic compound is a nitroaromatic compound.

25 11. The process of Claim 10 wherein the nitroaromatic compound is nitrobenzene, a nitrotoluene, a nitroxyline, a nitroanisole and a halogenated nitroaromatic wherein halogen in the halogenated nitroaromatic is Cl, Br, I, or F.

12. The process of Claim 7 wherein the nitroaromatic compound is dinitrotoluene.

13. An apparatus comprised of in combination a monolith catalytic reactor having an inlet and an outlet and a static mixer having an inlet and an outlet, said outlet of said static mixer in communication with the inlet of said monolith catalytic reactor.

14. The apparatus of Claim 13 wherein the monolith catalytic reactor has from 100 to 1200 cells per square inch.

15. The apparatus of Claim 14 wherein the static mixer is comprised of a plurality of parallel channels defining alternating flow paths which extend angularly to the longitudinal axis.

16. The apparatus of Claim 15 wherein the static mixers is comprised of a plurality of mixing sections with each mixing section rotated about the longitudinal axis in the direction of flow from the preceding section.

17. The apparatus of Claim 16 wherein the parallel channels interact at angles of 45 to about 90 degrees.

18. The apparatus of Claim 17 wherein the sections in the static mixer are rotated from about 45 to 90 degrees about the longitudinal axis from the preceding section in the direction of flow.

19. The apparatus of Claim 18 wherein the catalytic metal deposited on the surface of the monolith is a Group VIb, Group VIIb, or Group VIII or Group Ib metal.

8/20/2004

0053737 013103